FIGHT'S ON!

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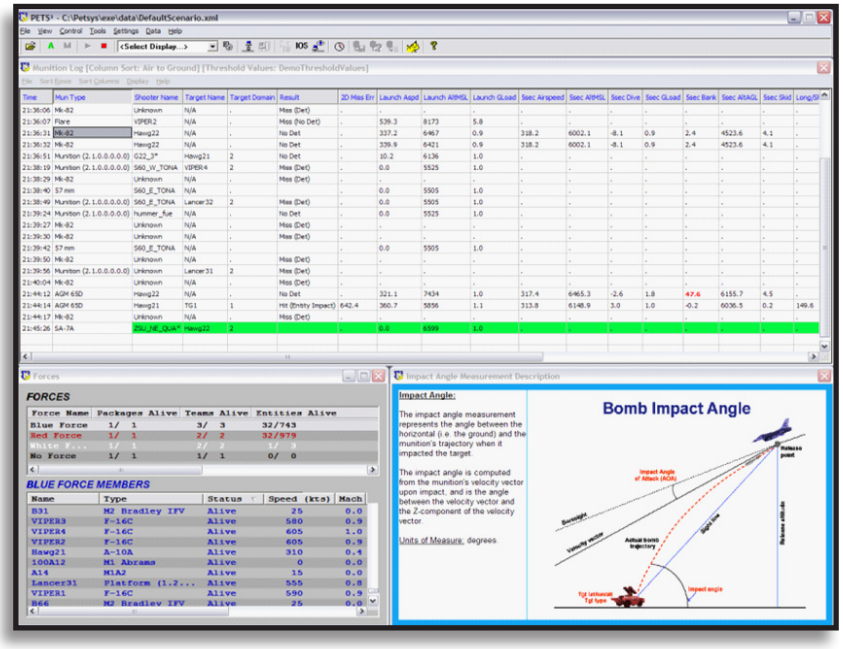
The Warfighter Readiness Assessment and Performance Measurement Tracking System Goes Operational!

Imagine a flight of two F-16 simulators and two real F-16s flying over a gun range in the next state directed by a joint tactical air controller immersed in a separate virtual reality environment nearby. The common link is that they all see and communicate with each other in real time, and share a training scenario from which data is recorded for later review and analysis. Welcome to the training environment known as Live-Virtual-Constructive (LVC).



The Performance Evaluation Tracking System developed by the 711th Human Performance Wing, Warfighter Readiness Research Division, gathers data from live, virtual, and constructive training events and measures warfighter performance and training effectiveness.

Key to gleaning useful information on the training effectiveness of the LVC environment is the Performance Evaluation Tracking System (PETS) developed by the 711th Human Performance Wing, Warfighter Readiness Research Division. The PETS development team—psychologists specializing in statistical, psychometric, experimental, industrial-organizational, and human factors psychology—consulted directly with warfighters to identify constructs and metrics of importance to them. Thus, the system looks for data to measure the constructs of interest to researchers and those measures that warfighters defined as relevant. Software engineers worked with the Warfighters to create the rule sets and algorithms that PETS uses to filter the data. PETS data can be used to assess learning, proficiency, and where the gaps are in learning. This permits assessments of the readiness "value" of live or virtual training hours because data are targeted to specific learning and readiness constructs, are available in real time, and can be used immediately for debriefing and assessment. The data can also be saved and used later to show how an individual's proficiency has changed over time, or to reveal where increased or targeted training may be needed to address deficiencies.

PETS is a suite of tools at the core of a recently completed Category I Advanced Technology Demonstration with Air Combat Command called the Warfighter Readiness Assessment and Performance Measurement Tracking System (WRAPMTS). The human-centered performance measurement standards developed for WRAPMTS are being implemented in the Combat Air Forces to support the Air Force migration to Proficiency-Based Ready Aircrew Program (P-RAP) training.

"The PETS research program represents a significant advance in pushing state-of-the-art measurement research and technology into the field," said Dr. Winston "Wink" Bennett, RHA technical advisor for training and assessment research. According to Dr. Bennett, PETS is not only a foundation for the P-RAP initiative, but the underlying measurement development and integration is a catalyst for work now underway with the Combined Air and Space Operations Center Performance Assessment System.

Integrating PETS into operational commercial training facilities such as the F-15 Mission Training Center (MTC) at Eglin AFB, the F-22 Flight Training Center at Langley AFB, the F-16 MTC at Aviano, Italy, and the F-22 Advanced Combat Simulation center at Marietta, GA, is beneficial because it enhances training analysis capabilities for both the Air Force and its partners by being a multi-platform, multi-security performance measurement system. By leveraging Cooperative Research and Development Agreements with multiple industry partners to streamline PETS integration into existing training systems such as the LVC demonstration, Project Alpine II, at the Boeing facility in St. Louis last fall, Air Force researchers sliced five years off industry-predicted development time for demonstrating practical LVC capability. To respond quickly to the dynamic challenges of today's operational environment, warfighter training needs to be flexible, effective, and efficient. Feedback from warfighters and researchers supports the conclusion that PETS and the underlying approach to human performance measurement are sound, valuable contributions to improving warfighter readiness.

Antoinette Portrey, Lockheed Martin
Winston Bennett, Jr., 711 HPW/RHAS

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eXpert Common Immersive Theatre Environment Used as Joint Terminal Attack Controller Training and Rehearsal Threat Generator

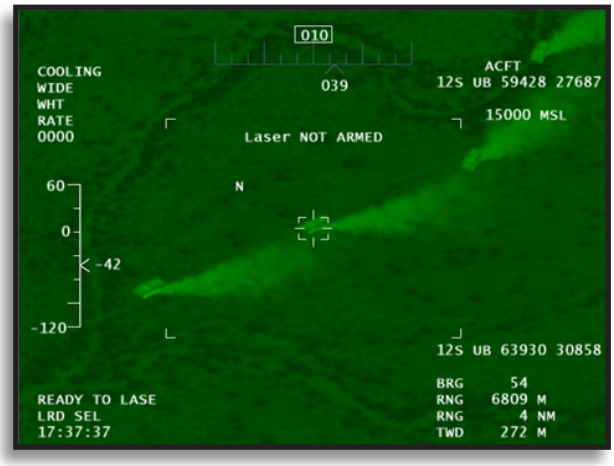
Joint Close Air Support (JCAS) research at the Warfighter Readiness Research Division 711 HPW/RHA continues with the Joint Terminal Attack Controller (JTAC) Virtual Trainer (VT) as the cornerstone of the JTAC Training and Rehearsal System (TRS). As the program moves from "proof of concept" to "operational training effectiveness testbed," unique training challenges and shortfalls are being addressed.

One of the challenges addressed by the JTAC TRS is the gap in live training and the ability to replicate a realistic scenario in an immersive decision-making environment. The ability to create a realistic training scenario that drives the appropriate decision-making process for a JTAC is complex. Previously the only way to accurately task saturate a JTAC was during conflict because the ability to control direct and indirect fire via fighter aircraft, artillery, attack helicopters, and Unmanned Air Vehicles (UAV) was rarely rehearsed on a training range. This is due to range restrictions, safety concerns, lack of assets, air space, and realistic training resources. The JTAC controls a two-ship of attack aircraft onto preplanned, static target sets. In a combat setting, however, a JTAC is expected to plan Close Air Support based on the ground commanders intent and asset availability, suppress enemy air defenses, deconflict airspace, and conduct target analysis while minimizing collateral damage and assessing the risk to friendly forces.

In an effort to provide a realistic and immersive environment to fill the training shortfalls, the JCAS team relies on 711HPW/RHA's eXpert Common Immersive Theater Environment (XCITE) team to provide a threat system with constructive battlespace models. Utilizing the JTAC VT's visuals and XCITE's physics-based threat models, the team is closing the training gaps that cannot be adequately represented or trained to in a live setting. A training scenario can be developed in the virtual trainer utilizing a full complement of weaponry from general purpose (GP) bombs, artillery, and even today's smart munitions. Range-per-munition, artillery systems, max ordnance height, and the lethal range of munitions have all been accurately replicated in the threat database.

The type of aircraft and enemy threat can also be selected from the hundreds of different air platforms, munitions, and threat models. In a more recent effort, the teams found that the XCITE database can also be used to stimulate the Multiple Unified Simulation Environment/Air Force Synthetic Environment for Reconnaissance and Surveillance (MUSE/AFSERS) to provide the JTAC a simulated Remotely Operated Video Enhanced Receiver feed.

View of the battle space



UAV view from MUSE/AFSERS on the IOS

So, why is the threat system so important in a simulated environment? The ability to task saturate a JTAC in a training environment so that he is ready and able to employ the appropriate decision-making process in combat is key. The XCITE database provides the appropriate combat threat models. The fully immersive dome allows the JTAC to have situational awareness of the battlefield to practice the visual and planning perspective with no safety concerns to the participant. A trainee can see in advance whether restrictions or other criteria would put an asset at risk, adjust engagement zones and airspace considerations, and create a different outcome that would better suit the mission.

The JTAC can then use his knowledge and training to select the appropriate munition to carry out the commander's intent. Buildings, civilians and other urban type infrastructure models can be included into the training scenario to complicate the decision-making process. The impact of being able to practice such a dangerous situation can refine tactics and procedures and potentially reduce risk to the warfighters during conflict. It also helps create a better understanding of the complexity of combining fires during wartime so that the JTAC is not employing mass fires, for the first time, in combat.

Lt Jonathan Neterer, 711 HPW/RHAE
Mr. Garry Boyle, 711 HPW/RHAE
Mr. Danny Sims, L-3 Communications

Coalition Live, Virtual, Constructive Operations and Training

The Live, Virtual, and Constructive (LVC) Training Research Team was awarded a $1.4M Coalition Warfare Program (CWP) proposal for FY10 and FY11. The RHAS Continuous Learning Branch was awarded a two-year effort to work with the United Kingdom's (UK) Defense Science and Technology Laboratory (DSTL) and the Mission Training through Distributed Simulation at the Air Battlespace Training Centre (ABTC), Royal Air Force (RAF) Waddington to further coalition LVC training. The team plans to install a 5-meter Joint Terminal Attack Controller-Training and Research System, develop a coalition version of the Performance Evaluation Tracking System, and demonstrate UK LVC operations between live assets and virtual players. The system will be used by DSTL and the ABTC to investigate the use of LVC operations with our foreign partners as well as research how operational personnel can use LVC technology. Use cases and best

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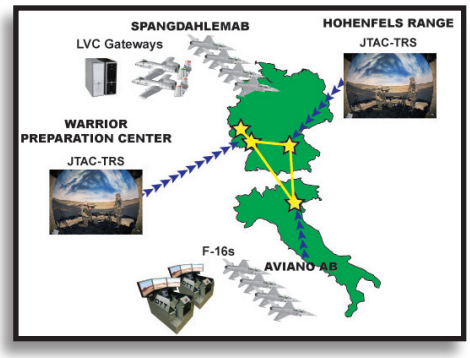
C-LVC OT Continued from page 2

practices will be developed and the foundation for coalition LVC operations and training (C-LVC OT) will be established. The C-LVC OT program will create a unique training environment, where all players - US air and ground, as well as coalition partners - are provided quality training including mission planning, briefing, execution, and debrief whether they are flying a live aircraft or participating in an air or ground simulation environment. C-LVC OT will also be a proving ground for joint and coalition training, rehearsal, and exercise interoperability standards development, validation, and refinement.

The goal of LVC operations is to provide warfighters in live aircraft the same complex combat environment and detailed replay and debrief tools as pilots in Distributed Mission Operations simulators. Both US Air Forces in Europe (USAFE) and the UK's RAF are developing networks for linking virtual and constructive simulations. Based on the cooperative research agreement between 711 HPW/RHA and UK's DSTL, the proposed LVC operations program will link USAFE and RAF simulator networks and attempt to incorporate live assets into networked training exercises. LVC operations have been developed at 711 HPW/RHA as a demonstration case for integrating and evaluating two-way communication and data transfer between live aircraft and real-time simulators including both warfighter-in-the-loop (virtual) and computer-generated (constructive). Using developed Mission Essential Competencies[SM] – key knowledge areas and skills to be trained – aircrews can use data collected from live and virtual missions to demonstrate quantitative mission performance metric tracking. 711 HPW/RHA took the lead in developing LVC enabling technology while integrating the training aspect into a more robust debrief. Data captured highlight numerous data points that were previously unobtainable during live-fly events. With the CWP effort, a coalition version of the program will be developed further aiding the training and debriefing capability of our allies.



Long-haul asset links Cross-Domain secure interplay to support 4th and 5th generation training, rehearsal, and exercise

Ms. Kristen Barrera, 711 HPW/RHAS

Instructional Science and Technology (S&T) for Cyberspace Operations

In December 2007, the Heritage Foundation reported that during fiscal year 07 the Department of Homeland Security received 37,000 reports of attempted cyber attacks on government and private computer systems. The Foundation also reported more than 80,000 attempted attacks on Department of Defense computers and networks. In April 2009, CBS reported Defense Secretary Robert Gates as saying "...the United States is under cyber attack... all the time... every day..... and the Department plans to quadruple the number of cyber security experts to ward off attacks." The Federal Bureau of Investigation has identified cyber attack as the third greatest threat to the United States after nuclear war and weapons of mass destruction.

United States Strategic Command (USSTRATCOM) and USAF Air Combat Command (ACC) have expressed needs related to cyberspace operations training. USSTRATCOM has requested tools to shorten and streamline the training process and ACC has requested a training range for realistic network warfare operations.

As a result, the 711 HPW/RHA Warfighter Readiness Research Division has initiated Science and Technology (S&T) to address these needs. The goals of the S&T are to accelerate learning and shorten the training process.

Cyberspace operations are unique in that information technology changes rapidly. To accelerate knowledge and skill acquisition to match rapid changes in technology, we need an agile training enterprise based on learning-by-doing with individualized instruction. In addition, special support is needed for the learner. Although top-level outcomes from cyber attack are observable, underlying processes are not. This unique feature of cyberspace operations suggests development of visualizations and animations to represent unobservable cyber processes to accelerate learner comprehension.

Research questions include:

- Can we accelerate learner comprehension by using visualizations and animations for unobservable cyber processes?
- Can we accelerate learning by using individually-tailored instruction?
- Can we accelerate "learning-by-doing" with realistic virtual training environments?

In addition to research questions, there are key engineering challenges. In 2007, the National Academy of Engineering identified fourteen grand challenges for the new millennium, two of which are relevant for this S&T. These are: personalized learning and advancing virtual reality.

Personalized learning is individually-tailored instruction; the gold standard for which is one-on-one tutoring. It has been empirically verified through replicated experimentation that consistently, on average, individuals who receive one-on-one tutoring perform two standard deviations greater than individuals trained through conventional classroom instruction. That is a huge advantage in favor of one-on-one tutoring, but it is too costly to implement on a grand scale. The engineering challenge of personalized learning is to make one-on-one tutoring affordable by applying the power of computer automation to trainee performance measurement, performance evaluation, feedback, development of exercise scenarios, and learning management.

The second engineering challenge is advancing virtual reality, which includes developing realistic virtual environments and simulators for learning-by-doing. If virtual training environments satisfy the goal for realism, trainees would have a déjà vu experience when they take their place on the operational line.

This S&T will lead the way in revolutionizing education and training for cyberspace operations and spin off advanced training technology for other skills. Most importantly, it will help address a major threat facing the United States.

Dr. Joseph Weeks, 711 HPW/RHAS

Cyber Friendly-Fire Avoidance Workshop (Cyber Fratricide Workshop)

On 3-4 February 2009, the 711th Human Performance Wing and the Information Directorate of Air Force Research Laboratory organized and hosted a workshop on cyber friendly-fire avoidance. The objective of the workshop sought to understand the prevalence of cyber friendly-fire, define a taxonomy, and develop a research direction to study the subject.

The workshop explored:

- How prevalent is cyber friendly fire?
- What are case examples of real world instances?
- What are the root causes?
- What are possible mitigating solutions, both technical and human factors, for cyber friendly fire?
- Are there cyber analogs of the Blue Force Tracker technology that have helped to mitigate physical friendly fire accidents?

The workshop had six working groups:

- Community of Practice (who's who)
- Taxonomy (definitions)
- Research Thrusts (where should we invest)
- Intelligence Gain/Loss
- Technical Forum
- Human Factors Analysis

The workshop participants included speakers and representatives from AFSPC/A3, 608 AOC/CC, 26 NOG/CC, AFRL/XPC, AF/A30-C, AFSPC/AC, AFOSR, AFIT, AFSPC/A8, Pacific Northwest Laboratory, and Georgia Tech Research Institute.

Findings included the requirement to differentiate between unintended consequences of offensive action against adversary targets versus unintended consequences of routine maintenance and defense of friendly targets. In addition, workshop participants identified several S&T challenges to reduce cyber fratricide and lessen its impact. The consensus from the workshop attendees was that the topic is important, and they would like to see the workshops continue. AFRL plans to host another workshop in September 2009 and will expand the invited attendees to include more organizations from outside the Air Force.

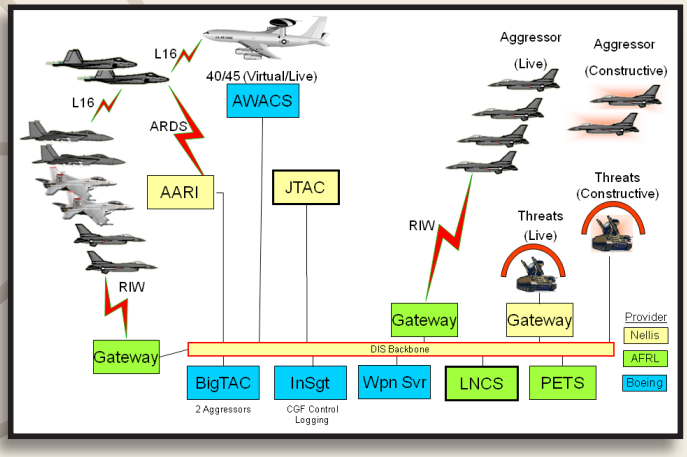
Persons on call for the workshop were Dr. Dee Andrews, Senior Scientist, Training Psychology, 711 HPW/RHA, and Dr. Kamal Jabbour, Senior Scientist, AFRL/RI.

Dr. Dee Andrews, 711 HPW/RHA

TARGETS OF OPPORTUNITY

Nellis Performance Assessment and Readiness Test and Training System Technology Transition Initiative Proposal

The Nellis Performance Assessment and Readiness Test and Training System (NPARTTS) Technology Transition Initiative was written with HQ ACC/A8A to transition a performance assessment and readiness test and training system to the Nellis Range. This system will facilitate performance based debrief capabilities for both live and simulated aircraft on the Nevada Test and Training Range (NTTR). By integrating several lab technologies within the NTTR infrastructure, the overall system will enable live and simulated aircraft flying on the NTTR to conduct more in-depth debriefs. The range infrastructure will create test and training synergies by laying the ground work for transfer of onboard aircraft data to the ground limiting the need for instrumentation of the airframe. Linking in other virtual type players such as the Joint Terminal Attack Controller Training Rehearsal System at Nellis into the NPARTTS will add an additional training dynamic at Nellis AFB. The effort is supported by the Office of the Secretary of Defense (Personnel & Readiness), HQ ACC/A8, and offices within the 4th and 5th generation program. This is seen as a risk reduction effort to further integrate live, virtual, and constructive entities within the Combat Air Force.



Bidirectional communication between live and virtual assets.

Ms. Kristen Barrera, 711 HPW/RHAS

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